Global metabolomics and lipidomics in a university hospital setting

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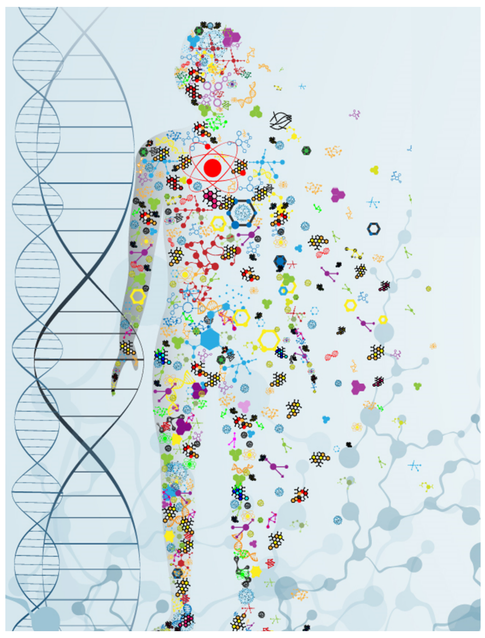

Characteristics, uses and possibilites of global metabolomics

- Thousands of metabolites (known and unknown) in a single drop of sample
- Detailed snapshot of the biochemical status
- The dynamic biochemical profile of the patient
- Unravelling pathophysiological processes and interconnected biochemical networks
- Biomarker discovery
- Diagnostics: Precisely identify the cause of the disease
- Personalized treatment:
  - Identify therapeutic targets
  - Choose best treatment options
- Monitoring of:
  - Disease progression, remission and recovery
  - Effect of treatment
  - Adherence or non-compliance to treatment

Challenges related to clinical applications of global metabolomics

- Robust analytical platform and methodology needed
- Documentation of quality assurance
- Awareness of and handling of biological variation
- Control of preanalytical factors
  - Sampling procedures and materials/additives
  - Sample processing, transport and storage
- Controls and reference ranges needed
  - Local reference range database
  - and/or compare with matched controls
  - and/or patient as her own control (longitudinal samples)
- Standardized postanalytical processing
  - Quality assurance
  - Address and answer physician's explicit request
  - Standardized report with all necessary information

Methods: Standardized and quality-assured preanalytical, analytical and postanalytical workflow

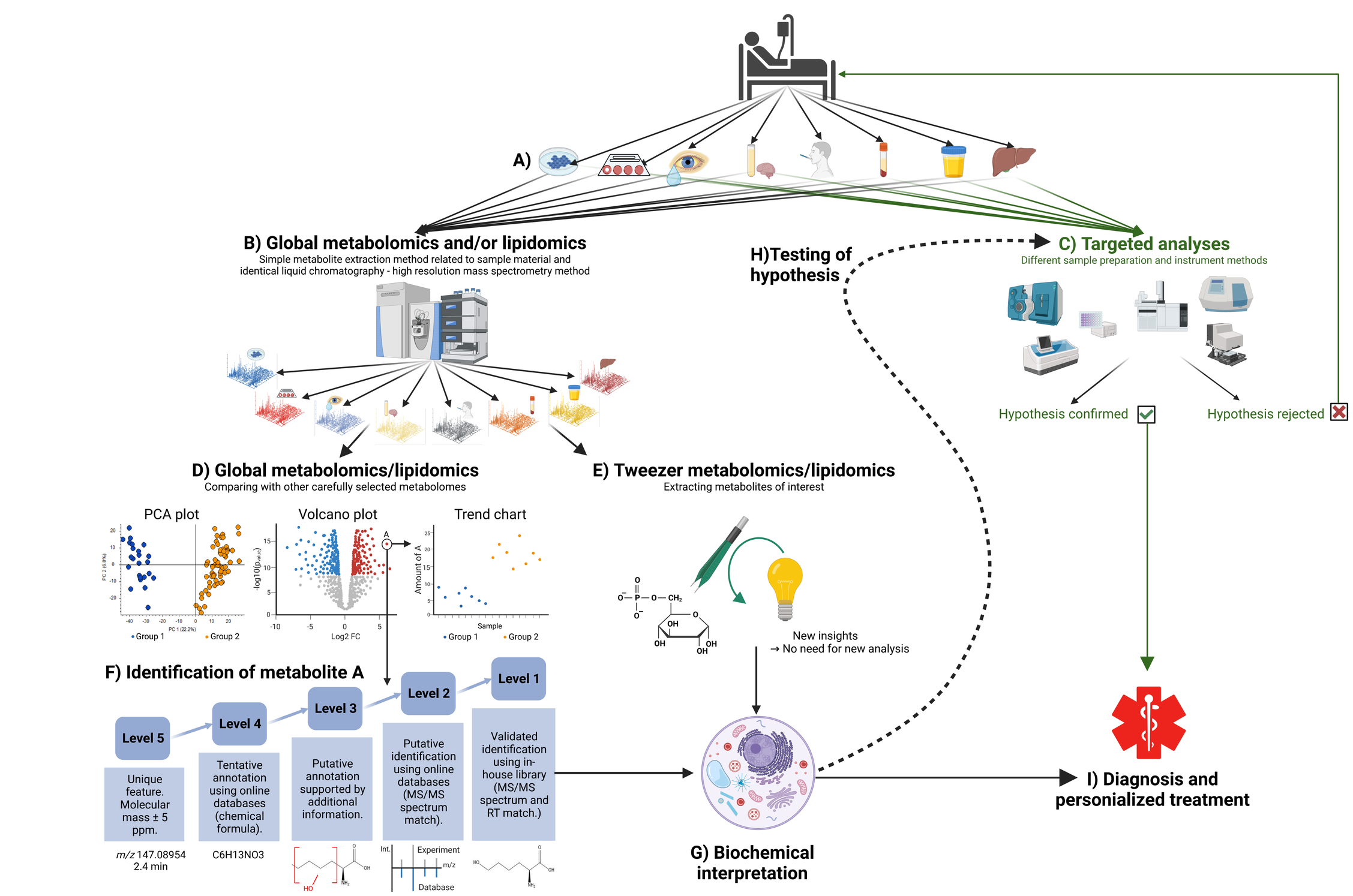

Figure 1: Workflow for clinical diagnostics and personalized medicine: Metabolites from any biofluid, tissue sample, organoid or cell culture are extracted using sample-specific protocols (A). One common LC-MS method for metabolomics (1) and another for lipidomics provide the individual global sample metabolomes and lipidomes for hypothesis generation (B). Targeted analyses using different instruments and methods for testing hypotheses and more accurate quantification (C). Global analysis of all metabolites (D) or selected extraction of metabolites of interest (E) generates metabolites that need level 1 of identification (F) to be used for biochemical interpretation (G) and use in diagnostics and personalized treatment (I). For more precise quantification and confirmation, targeted analyses are often used (C) to test hypotheses (H) generated from global analyses.

Conclusions

Global metabolomics and lipidomics offer immense opportunities for novel understanding of the biochemistry and physiology of health and disease and discovery of biomarkers for diagnostics, choice of therapy and monitoring of disease processes and effect of treatment, and detecting non-adherence to treatment (2-6).
However, there is a long way from global metabolomics and lipidomics as research tools to quality-assured provision of clinical diagnostics and personalized treatment recommendations and montoring (2, 5, 7).

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